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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/622,532	07/18/2003	Won Kwon Lee	29936/39477	2813

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EXAMINER

DEO. DUY VU NGUYEN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 06/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/622,532

Applicant(s)

LEE, WON KWON

Examiner

DuyVu n. Deo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 18 July 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 7/18/03.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu (US 5,998,278), Koh (US 2003/0022458), and Williams et al. (US 6,589,897).

Yu teaches a method for forming shallow trench isolation comprising: forming a stack structure of pad oxide layer 21, a polysilicon layer 22, a photoresist layer pattern on a semiconductor substrate; removing the photoresist pattern (col. 2, line 45-65; fig. 2B, 2C); oxidizing the polysilicon surface to form a surface oxide film 22b (col. 3, line 26-30); forming an insulating layer over the entire structure to bury a trench (col. 2, line 67-col. 3, line 12); polishing the insulating layer (col. 3, line 13-15); removing the polysilicon (or the oxide film 22b) and the pad oxide layer 21 (col. 3, line 31-34).

Unlike claimed invention, Yu doesn't describe the stack include an amorphous silicon layer but a polysilicon layer 22. Koh (US 2003/0022458) teaches a same method where he teaches the stack structure can include either polysilicon or amorphous silicon layer (paragraph [0025]). Therefore, it would be obvious to one skilled in the art at the time of the invention in light of Koh that using either polysilicon or amorphous silicon layer would be obvious and provide an expected result.

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Unlike claimed invention, Yu doesn't describe performing an over etch so that polymer formed at a corner of the isolation region to form an etch slant face at the corner of the isolation region while etching the central portion of the isolation. Williams et al. (US 6,589,897) teaches a method for forming the shallow trench isolation wherein he teaches of the above step using gases including CHF<sub>3</sub> or CF<sub>4</sub> (col. 4, line 50-56; col. 5, line 15-25). It would have been obvious for one skilled in the art to modify Yu in light of Williams' teaching because he teaches that it is desired to have a soft shoulder or trench tapering since it affect the performance and reliability of the semiconductor devices (col. 2, line 15-25, 64-67).

Williams also teaches using of ARC to facilitate the photographic definition of the feature (col. 1, line 38-40, 53-56). Since the ARC must formed directly under the photoresist (or above other layers including the above polysilicon layer or amorphous layer) in order to facilitate the photographic definition, it would be obvious to remove the ARC in order to expose the polysilicon or amorphous layer for the oxidation step.

Referring to claim 16, the Yu's silicon nitride 23 would read on claimed hard mask (col. 2, line 53-54). Williams teaches that the polymer is to protect the silicon corner slope (col. 4, line 50-55). Therefore, the polymer would be mask when etching the silicon substrate (col. 5, line 28-30). Koh also teaches to form the oxide on the amorphous silicon surface (paragraph [0026]). Figure 2G shown by Yu teaches that all layers, which would includes the oxide film on the amorphous silicon surface, the amorphous silicon film, and the pad oxide would have to be etched away in order to form an isolation trench.

Referring to claims 14-17, even though above applied prior art doesn't suggest forming the surface oxide by method such as O<sub>2</sub> ashing process at T 50-200 degree Celsius. However, at

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the time of the invention, using method such as O<sub>2</sub> ashing plasma, which is known to one skilled in the art (please see Lee et al. US 6,277,707 col. 5, line 15-20), would be obvious in order to oxidize the amorphous or polysilicon layer to form an oxide layer with a reasonable expectation of success.

Referring to claim 12, Williams teaches that the degree of shoulder shaping can be adjusted for different designs (col. 2, line 20-26). Therefore, it would have been obvious that the degree of tapering and the width of the slant faces ranges would have to be determined and adjusted through routine experimentation as suggested above by Williams in order to provide an optimum degree of shoulder shaping with a reasonable expectation of success.

3. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yu, Koh, and Williams as applied to claim 10 above, and further in view of Kim et al. (US 6,461,937).

Referring to claim 13, figure 2B by Yu further shows the sidewall and bottom of the trench is oxidized to form a surface oxide before oxidizing the polysilicon. Unlike claimed invention he doesn't describe that this is done after removing the ARC film. Kim shows a same method of forming STI wherein he describes this oxidation step is done after removing the ARC film (col. 1, line 44-47). It would have been obvious for one skilled in the art to form a STI further in review of Kim's teaching because Kim teaches a step that is silent by Yu in order to provide a method for forming a STI with a reasonable expectation of success.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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5. Claims 1-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The limitation, in claim 1, "forming a stack structure of a pad oxide film and a photoresist which an isolation region is defined pattern on a semiconductor substrate" is vague.

6. Claims 16-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The limitation, in claim 16, "burying the trench with an insulating film and then removing the polymer film and a hard mask film" is vague. It is unclear how the hard mask is related to the trench in the first place. It is suggested that the limitation, in claim 16 "...oxidizing the amorphous silicon film on the amorphous silicon film..." should be "...oxidizing the surface of the amorphous silicon film..." or just "...oxidizing the amorphous silicon film..." in order to provide a concise limitation.

7. Lee et al. US 6,277,707 col. 5, line 15-20, is cited to show prior art.

***Priority***

8. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Republic of Korea 2002-84281 and 2002-65753 on 12/26/02 and 10/28/02. It is noted, however, that applicant has not filed a certified copy of these applications as required by 35 U.S.C. 119(b).

***Allowable Subject Matter***

9. Claims 1-9 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action. Claims 1-9 are allowed

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because applied prior art doesn't suggest or teach that the photoresist pattern containing silicon and oxidizing the photoresist pattern to form a surface oxide film. Applied prior art teaches using the photoresist to etch the polysilicon or amorphous silicon layer, which is then oxidized to form a surface oxide film.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-3:30; with alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Primary Examiner

Duy-Vu N. Deo

6/9/05

